emphasis. Yet in life we have to select, and the exercise of choice is of first importance." The text in question helps the teacher to "exercise choice" very admirably. Different kinds of type are used to indicate the relative importance of theorems. Enough problems are given so that the exceptional pupil may have the stimulus he needs; the medium pupil a fair number; and the slow, plodding pupil enough to make the subject interesting and significant, yet not too difficult. The Appendix to Plane Geometry treats of maxima and minima.

The next three chapters—VI–VIII—are devoted to Solid Geometry. They are made attractive to look at by phantom half-tones. The reviewer would venture the criticism that these "phantom" half-tone engravings, while perhaps making the figures more realistic to the pupil, defeat one of the aims of solid geometry, that is, to develop the imagination. Many of the proofs of the theorems in this division of the book are given in outline only. There are 250 exercises in the Solid Geometry.

A decided innovation in this text is the introduction of three sets of tables. Table I gives the ratios of the sides of right triangles and chords and arcs of a unit circle. This indicates, of course, that the fundamental trigonometric ratios are introduced under proportion and similarity. All starred exercises indicate the use of these ratios. To quote from Article 112, "The relations between chords, arcs, and central angles of the same circle appear vividly in connection with rotations, ... Taking the radius as 1 unit, the lengths of the chords corresponding to various central angles for every degree from 0° to 90° are given in the table of chords." Table II gives powers and roots with an accompanying explanation for use. Table III gives a list of important numbers.

Very few historical notes are given. Such names as Pythagoras, Aristotle, Euclid and Bhaskara are mentioned in connection with famous theorems.

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A Text-Book of Mathematics and Mechanics, specially arranged for the use of students qualifying for science and technical examinations. By CHARLES A. A. CAPITO. Charles Griffin & Co., London; J. B. Lippincott Co., Philadelphia, 1913. xv + 398 pages.

As the title indicates this is a drill book for the use of persons preparing to take certain examinations; it is admirably adapted to this purpose and one can well believe that it grows out of a long and successful experience in coaching. The theory is presented concisely and, generally, with great clearness. Although extreme brevity characterizes the treatment throughout, space is devoted to the solution of numerous problems, most of which are taken from examination papers of recent date.

The author presumes a knowledge of elementary algebra and trigonometry, and begins with a section on plane analytic geometry, which is followed by sections on differential and integral calculus and mechanics, including hydromechanics

and pneumatics. The section on analytical geometry presents in 46 pages the common theorems relating to the straight line, the circle, and the other conic sections. This is followed by a set of 22 problems with a complete solution for each.

The section on differential calculus covers 59 pages, including 18 pages devoted to the solution of examples. This is brief indeed and quite unsatisfactory from the point of view of its future application in problems of mechanics and physics. In the introduction of the derivative, accuracy of statement is sacrificed to brevity; the process of passing to a limit is not carefully explained, the undetermined form 0/0 is scarcely more than mentioned and that in a confusing manner, and the equation

$$dy = f'(x)dx$$

is said to be a conventional form of the equation

$$\frac{dy}{dx} = f'(x),$$

introduced for the purpose of saving space. Aside from the Taylor and Maclaurin series the applications of the derivative are almost exclusively geometrical. Applications and interpretations of the derivative according to the method of rates, and the uses of the derivative in approximate computations by the method of differentials are practically excluded from consideration. Likewise, in the presentation of the integral calculus the process of integration is not treated as the limit of a process of summation but only as the reverse of the differentiation process. Thus those methods of the calculus which have proved most fruitful in the study of physical phenomena are set aside in favor of those which admit of brief and simple presentation with a minimum of logical difficulty.

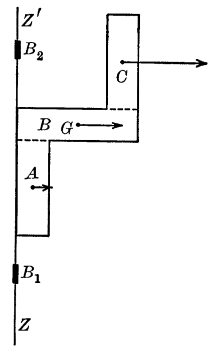
The presentation of Taylor's series is the one which was current in elementary text-books some twenty years ago when the function was assumed expressible in power series and the problem of determining the coefficients was solved by successive differentiations of the series, term by term.

The section on mechanics begins on page 170 and fills the remainder of the 398 pages of the book. The treatment here is in the main admirable, though always very brief. Liberal space (94 pages out of 228) is devoted to the solution of problems. Statics is disposed of in eight pages and kinematical discussions are omitted altogether. The space is therefore practically all devoted to the study of kinetics, with chapters on hydromechanics and pneumatics. The matter of dimension in terms of the fundamental quantities, mass, length and time, is kept well in the foreground. This feature contributes much to the value of the book.

In the words of the author this section "has been written with the intention of avoiding, as far as possible, the unscientific and erroneous expressions still employed by writers of the present day." Just what these expressions are does not appear very prominently, but the author has maintained a satisfactory standard of accuracy and rigor throughout this section. He objects to the use

of the term "centrifugal force," in which objection many of those interested would not concur. This term has been abused by some and confused by others but it has a legitimate place in the theory of mechanics. In defining the unit of time the author states that it is the second, which is 1/86164 of the time the earth takes to complete one revolution about its axis. The second is usually defined as 1/86400 of a mean solar day. It is undoubtedly important that attention should be called to the fact that, owing to its orbital motion, the earth does not complete a revolution about its axis in one mean solar day, but the definition substituted by Capito is open to the objection that it is accurate to five significant figures only, whereas the other is precise as a definition, and capable of expression in terms of other phenomena with an increasing degree of accuracy as the number and accuracy of observations increases.

The unit of mass is defined as ".001 of the mass (at 0° C.) of a standard piece of platinum, etc." The reason for mention of temperature in this connection is not obvious.



An error is committed in the derivation of expressions for the pressure exerted upon bearings when a body of irregular shape rotates about a fixed axis (see p. 326, formula 2). According to this formula the X component of the bearing stress due to the centrifugal action of a rotating mass would be found by assuming the mass to be concentrated at its mass center. That this is incorrect will appear by reference to the figure. The Z-shaped lamina ABC rotates about the shaft ZZ', each of the three sections exerting upon the shaft a force, as indicated by the arrows. Clearly the resultant of these three forces does not pass through G, the center of gravity of the whole mass.

Formally considered the error consists in setting

$$\Sigma mxz = Mr_g\gamma,$$

where r_g is the distance of the center of gravity from the Z axis and γ is the Z coördinate of the center of gravity. This equation is satisfied when the mass M has a plane of symmetry perpendicular to the Z axis. It may be satisfied even when there is no such plane of symmetry, but in general it is not satisfied.[1]

The book has been prepared with great care and attention to detail. Only one misprint was noticed and that was a misspelled word. Numerous figures are furnished and they are clear and helpful. Care has been exercised to maintain a high standard of logical consistency, though some conspicuous lapses have been made in this particular. Perhaps the most serious objection to the book is its failure to develop and utilize those methods of the calculus which have proved most fruitful in the physical sciences. However this criticism would undoubtedly apply with more or less force to most of the elementary calculus texts now in use. The book would not prove satisfactory as a text for use in a first course in any of the branches which it covers, but it would be very helpful in the field for which

[1] See "the theorem of parallel axes" in Routh's *Elementary Rigid Dynamics*, ed. 1905, p. 10.

it was intended, that is, as a review outline for persons preparing to take examinations in elementary mathematics and mechanics.

The plan and style of this book suggest very forcibly some of the advantages and disadvantages of an examination system. Definiteness, conciseness and a certain degree of precision are encouraged but there is danger of stimulating over-use or mis-use of the memory, and discouraging breadth and originality of view and interest in larger problems that cannot be handled adequately within the space of an examination period.

BURT L. NEWKIRK.

PROBLEMS AND SOLUTIONS.

B. F. FINKEL, CHAIRMAN OF THE COMMITTEE.

PROBLEMS FOR SOLUTION.

SPECIAL NOTICE. In proposing problems and in preparing solutions, contributors will please follow the form established by the MONTHLY, as indicated on the following pages.

In particular, a solution should be preceded by the number of the problem, the name and address of the proposer, the statement of the problem, and the name and address of the solver.

The solution should then be given with careful attention to legibility, accuracy, brevity without obscurity, paragraphing and spacing, having in mind the form in which it will appear on the printed page.

Please use paper of letter size, write on one side only, leaving ample margins, put one solution only on a single sheet and include only such matter as is intended for publication.

Drawings must be made *clearly* and *accurately* and an extra copy furnished on a *separate sheet* ready for the engraver.

Unless these directions are observed by contributors, solutions must be entirely rewritten by the committee or else rejected.

Selections for this department are made two months in advance of publication.

Please send all solutions direct to the chairman of the committee.

MANAGING EDITOR.

ALGEBRA.

Solutions of 408, 409, 410, 411, 412, 413, 414, and 415 have been received. A solution of 406 is desired.

418. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Form the algebraic equation whose roots are $a_1 = 2\cos(2\pi/15)$, $a_2 = 2\cos(4\pi/15)$, $a_3 = 2\cos(8\pi/15)$, and $a_4 = 2\cos(14\pi/15)$.

419. Proposed by GEORGE A. OSBORN, Massachusetts Institute of Technology.

Show that

$$(1^5 + 2^5 + 3^5 + \cdots + n^5 + 1^7 + 2^7 + 3^7 + \cdots + n^7 = 2(1 + 2 + 3 + \cdots + n)^4.$$

GEOMETRY.

Solutions of 437, 438, 439, 440, 443 have been received. Solutions of 427, 430, 432 and 433 are desired.

447. Proposed by HORACE OLSON, Chicago Illinois.

Given the edge of a regular tetrahedron, find the radius of the circumscribed sphere.